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American Potato Journal

Volume 24 MAY, 1947 Number 5

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PUBLISHED MONTHLY AT

THE POTATO ASSOCIATION OF AMERICA

New Brunswick, New Jersey

Subscription Price $2.00 Per Year

Entered as second class matter at New Brunswick, N. J., March 14, 1942, under Act of March 3, 1879.

Accepted for mailing at special rate of postage provided for in section 412. Act of February 28, 1925, authorized on March 14, 1928.

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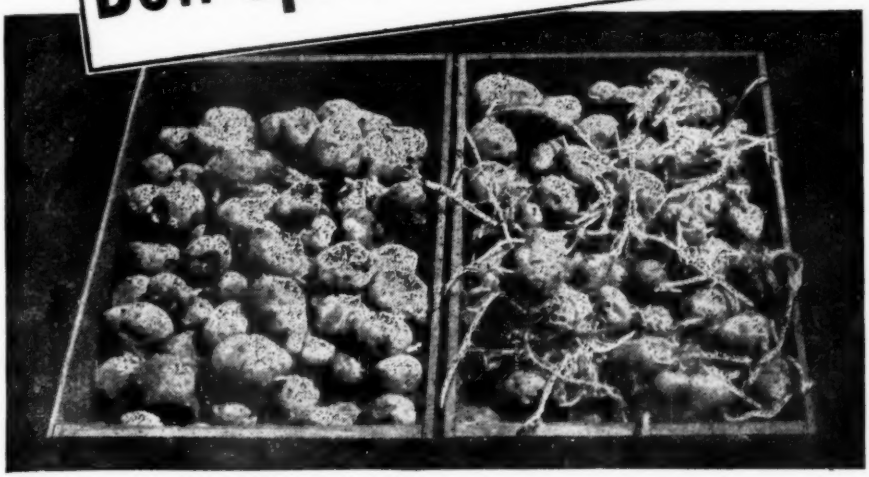

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NEW BRUNSWICK, N. J.

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FIELD TESTING OF DISINFECTANTS FOR THE CONTROL OF POTATO RING ROT BACTERIA ON WOODEN AND METALLIC SURFACES

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INTRODUCTION

Ten years ago, when potato ring rot was first discovered in the United States, uncertainty existed concerning its importance. Now a decade later, the disease is recognized as ranking among top troubles in the production of potatoes.

Its control, however, is relatively simple, consisting of but three steps: 1) removal of all potato stocks from the infected farm; 2) disinfestation of all surfaces having come in contact with the diseased potatoes; and 3) procurement of new seed stocks that are free from ring rot. If properly carried out, this three-point program will eradicate ring rot virtually overnight.

Failure, however, results when one or more of these requirements is neglected. Step No. 1—the removal of all potatoes—is simple to follow and will start the way to successful clean-up provided no exception is made to the word "all." This means getting rid of table-stock and home-use lots as well as seed lots supposedly healthy or not.

Step No. 2—the disinfestation of all surfaces having come in contact with infected potatoes—is more difficult to practice. It involves knowing what surfaces should be cleaned, and what chemicals to use in the process.

Step No. 3—the procurement of new seed free of the disease—can best be followed at present by use of certified seed. While such seed has at times been found to contain ring rot, its use still offers the only available solution to the replacement problem on a commercial scale. Much remains, however, to be done under Step 3 by seed improvement agencies. Foundation stocks should be developed which are laboratory-tested and *known* to be free of the disease.

Procedures and Results

The results presented in this report bear on the chemicals to be employed in eradicating ring rot. In the past, success of the three-point program has often been jeopardized by use of analogies concerning disinfectants to be applied. For example, formaldehyde has been recommended for ring-rot disinfestation because of its general bactericidal efficacy elsewhere. Yet when tested against ring rot, formaldehyde was found by several investigators (Starr, 1940; Scott *et al.*, 1941; Knorr 1944) to afford not only *no* control, but actually to cause a spread of ring rot. Other recommendations, also of dubious reliability, have been based simply on laboratory tests. Because copper sulfate was found to kill pure cultures of *Corynebacterium sepedonicum* on toothpicks, it has been concluded that copper sulfate could be used to clean up crates and walls of storages. This paper summarizes work conducted over the past four years in evaluating bactericides for the control of ring rot bacteria *under field conditions*. Since no one experiment can anticipate all variations in field practice, the attempt has been made in these tests to make each trial as severe as possible.

The three types of ring-rot harboring surfaces encountered in potato production are wooden, metallic, and fibrous. Of these, the first two only are dealt with here. The disinfestation of fibrous bags has already been reported on by others; and recommendations that have been made are well grounded in experimental results. Some examples of wooden surfaces encountered in potato production which may be contaminated with the ring-rot bacterium are: crates, baskets, barrels, weighing platforms, warehouse walls, and truck bodies. Metallic surfaces include scoops, diggers, graders, washers, elevators, cutting knives, and planters.

Disinfestation of Wooden Surfaces

In the testing of wood disinfectants, field conditions were simulated by the use of wooden potato crate slats 2 inches wide and 14 inches long, each of which was rubbed vigorously with a ring rot diseased potato. In this manner the pathogen together with the attendant ooze and tuber

tissue was worked well into the wood. The inoculated slats were then allowed to dry for 24 hours. Following this they were divided into lots of 40, submerged 1 minute in the various solutions being tested, and allowed to dry. Checks went untreated. Twenty-four hours after removal from the dips, the slats were rubbed with the freshly cut surfaces of healthy potatoes, in this way picking up whatever ring rot bacteria had survived the treatment. Using precautions against recontamination, the cut seed were placed by hand in randomized rows 100 feet long and in 4 replications. Wilting of infected hills or visible tuber rotting (as variously indicated in table headings of the different tests) was taken as the index of ring rot.

Table 1 presents results obtained from comparing copper naphthanate (Green CUPRINOL brand), chlorinated phenols (PERMATOX F brand), an approximately equal mixture of lauric and myristic fatty acid esters of colamino formyl methyl pyridinium chloride (EMULSEPT brand), alkyl dimethyl benzyl ammonium chlorides (ROCCAL brand), copper sulfate, mercuric chloride and calcium hypochlorite with an untreated check. All treatments gave significantly less ring rot than the untreated check. However, complete control (*i.e.*, complete disinfestation) was obtained only in the case of copper sulfate, mercuric chloride, and ROCCAL at the concentrations indicated in the table. The use of copper naphthanate and chlorinated phenols was inhibitory to corking over of the seed, and this resulted in a subsequent reduction in stand.

Table 2 compares the disinfecting abilities of various concentrations of alkyl dimethyl ammonium chlorides (ROCCAL brand) and of diisobutyl phenoxy ethoxy ethyl dimethyl benzyl ammounium chloride (HYAMINE 1622 brand), copper sulfate, coal tar phenols (PRATT'S Stock Dip brand) and a 6 to 10 per cent ammoniacal solution of copper-zinc-phenol (ACZOL brand) with an untreated check. ROCCAL, which previously gave complete control at 1:500 is here represented by dilutions of 1:50,000 and 1:100,000, neither of which was adequate for control. HYAMINE 1622 at dilutions of 1:20,000 and 1:40,000 failed to produce control significantly better than the untreated check. Copper sulfate, previously used at the rate of 2 pounds in 10 gallons water to give complete control, was this time tested at 1 pound in 10 gallons—and again the control was absolute. The coal tar phenols at 1:25 and ACZOL at 1:10 also produced complete control.

Disinfestation of Metallic Surfaces

In testing disinfectants for metallic surfaces, metal parts harboring ring-rot bacteria such as planters, diggers, etc., were simulated by screws 2 inches long and No. 8 in diameter. These were thrust into the vas-

TABLE 1.—*Comparison of 7 treatments for the disinfestation of wooden surfaces for the control of potato ring rot. (Messrs. C. and R. VanDuser farm, Auburn, N. Y.)*

DISINFECTANT	CONCENTRATION	HILLS/FOUR 100-FOOT REPLICATIONS		
		Healthy	Diseased	Total
1. CUPRINOL Green	Undiluted	212	6**	218**
2. PERMATOX F	1:10	202	5**	207**
3. EMULSEPT	1:500[1]	284	10*	294
4. ROCCAL	1:500[1]	256	0**	256**
5. Copper sulfate	2#/10 gals. water	282	0**	282*
6. Mercuric chloride	1:500	295	0**	295
7. Calcium hypochlorite	5000 ppm. avail. Cl_2	330	2**	332
8. Untreated check		300	33	333

*Significantly different from "Untreated checks" at 5 per cent level.
**Significantly different from "Untreated checks" at 1 per cent level.
[1]Based on active ingredient.

Variety: Katahdin (New York State Certified)
Date planted: May 27, 1944.
Date final ring rot reading: September 19, 1944.

TABLE 2.—*Comparison of 7 treatments for the disinfestation of wooden surfaces for the control of potato ring rot. (Kenneth MaGahan farm, Cooks, Michigan.)*

DISINFECTANT	CONCENTRATION (Active Ingredient)	HILLS/FOUR 100-FOOT REPLICATIONS		
		Healthy	Diseased	Total
1. ROCCAL	1:50,000	287	34	321
2. ROCCAL	1:100,000	268	40	308
3. HYAMINE 1622	1:20,000	298	26	324
4. HYAMINE 1622	1:40,000	242	20	262*
5. Copper sulfate	1#/10 gals. water	230	0**	230**
6. Coal tar phenols	1:25[1]	257	0**	257*
7. ACZOL	1:10[1]	229	0**	229**
8. Untreated check	—	295	24	319

*Significantly different from "Untreated checks" at 5 per cent level.
**Significantly different from "Untreated checks" at 1 per cent level.
[1]Concentration based on retail stock solution.

Variety: Pontiac. No systemic ring rot encountered while cutting 3200 seed pieces, nor was the disease observed in the 100 hills hills planted to whole, uncontaminated seed.
Date planted: June 14, 1946.
Date final ring rot reading. September 9, 1946.

cular region of ring-rot-diseased potatoes, and upon withdrawal the threads were well packed with a mixture of organic matter and bacteria, thereby affording an unusually severe test of the disinfecting ability of the chemicals being studied. The screws were then allowed to dry from 12 to 24 hours, after which time the debris between the threads appeared dry. Forty contaminated screws were so prepared for each disinfectant tested, placed on a metal screen, immersed in the appropriate chemical for 1 minute, and then allowed to dry for 24 hours. Check screws were not disinfested.

At the end of the 24-hour drying period, seed pieces cut from ring-rot-free potatoes were pierced with these screws so that the threads passed through the vascular ring. Each screw was used to inoculate 10 seed pieces, and 400 seed pieces were prepared for each treatment. Planting was done in 100-foot rows, four randomized replications to the plot.

Table 3 shows the number of healthy and diseased hills resulting from this procedure with the following chemicals: copper sulfate, calcium hypochlorite (PERCHLORON brand), alkyl dimethyl benzyl ammonium chlorides (ROCCAL brand), formalin, and pentachlorphenol (SANTOPHEN 20 brand). Using the same technique, various other disinfectants were tried as reported in table 4; these were alkyl dimethyl benzyl ammonium chlorides (ROCCAL brand), an approximately equal mixture of lauric and myristic fatty acid esters of colamino formyl methyl pyridinium chloride (EMULSEPT brand), di-isobutyl cresoxy ethoxy ethyl dimethyl benzyl ammonium chloride (HYAMINE 10x brand), alkyl dimethyl 3, 4- dichlorobenzyl ammonium chloride (TETROSAN brand), lauryl isoquinolinium bromide (ISOTHAN Q-15 brand), phenyl mercuri triethanol ammonium lactate (PURATIZED brand), and sodium paratoluene sulfonchloramide (STERI-CHLOR brand). Some of the foregoing chemicals were also tested at intermediate concentrations, but due to late planting and early frost-killing of the plots, insufficient ring rot developed even in the checks to warrant gathering data.

Conclusions and Discussion

In summarizing the above results on wood disinfectants, it can be said that at proper dilutions complete eradication of wood contamination was obtained by use of copper sulfate, mercuric chloride, coal tar phenols, alkyl dimethyl benzyl ammonium chlorides, and an ammoniacal copper-zinc-phenol solution. Incomplete control at the concentrations tested resulted from the use of copper naphthanate, chlorinated phenols, N(higher acyl esters of colamino formyl-methyl) pyridinium chloride, calcium hypochlorite, and di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride .

TABLE 3.—*Comparison of 5 treatments of metallic surfaces for the control of potato ring rot. (Harry Wagner farm, Baldwinsville, New York.)*

DISINFECTANT	CONCENTRATION	HILLS/FOUR 100-FOOT REPLICATIONS		
		Healthy	Diseased	Total
1. Copper sulfate	2#/10 gals. water	381**	0**	381
2. Calcium hypochlorite	5000 ppm avail. Cl_2	374**	10**	384
3. ROCCAL	1:1280 (act. ingred.)	374**	5**	379
4. Formalin	1:10	375**	0**	375
5. Pentachlorphenol	2 per cent	373**	6**	379
6. Untreated check	—	247	130	377

*Significantly different from "Untreated check" at 5 per cent level.
**Significantly different from "Untreated check" at 1 per cent level.

Variety: White Rural (New York State certified).
Date planted: June 13, 1944.
Date final ring rot reading: September 25, 1944.

TABLE 4.—*Comparison of 7 disinfectants of metallic surfaces for the control of potato ring-rot. (Lawrence Lindstrom farm, Iron River, Michigan.)*

DISINFECTANT	CONCENTRATION (Active Ingredient)	LBS. TUBERS/FOUR 100-FOOT REPLICATIONS		
		Healthy	Diseased	Total
1. ROCCAL	1 :1000	356.5	0	356.5
2. EMULSEPT	1 :1000	364.5	0	364.5
3. HYAMINE 10X	1 :1000	364.0	0	364.0
4. TETROSAN	1 :1000	357.0	1.0	358.0
5. ISOTHAN Q-15	1 :1000	351.0	0	351.0
6. PURATIZED	1 :1000	347.5	0	347.5
7. STERI-CHLOR	2000 ppm avail. Cl_2	360.0	2.5	362.5
8. Untreated check	——	314.5	17.4	331.9

Variety: Pontiac. No systemic ring rot encountered while cutting 3200 seed pieces, nor was the disease observed in the 100 hills planted to the whole, uncontaminated seed.
Date planted: June 6, 1946.
Date harvested and read: September 12, 1946.

It appears from the data that some wood disinfectants cause significant reductions in stand or yield. It must be remembered, however, that the freshly cut surface of each seed was rubbed over the slats within 24 hours of treatment and that in this way a considerably greater amount of chemical was picked up than would ordinarily occur under field conditions. A hazard of a more serious sort did arise with the use of chlorinated phenols and copper naphthanate; these chemicals with their organic solvents inhibited corking-over almost completely and reduced the cut surfaces of seed to layers of slime within 24 hours.

As just pointed out, there are a number of chemicals that will completely eradicate ring rot contamination. From an extension worker's standpoint, however, the easiest of these to recommend is copper sulfate (1 pound in 10 gallons water). Blue vitriol has the advantages of being cheap and being readily available; furthermore, it is a fair wood preservative, thereby enabling the user not only to kill contaminating bacteria but at the same time to preserve his storage walls and crates.

Summarizing the data on metal disinfectants, it can be stated that ring rot contamination is inactivated on planters, diggers, graders and other metallic surfaces by alkyl dimethyl benzyl ammonium chlorides, N(higher acyl esters of colamino formyl methyl) pyridinium chloride, di-isobutyl cresoxy ethoxy ethyl dimethyl benzyl ammonium chloride, lauryl isoquinolinium bromide, phenyl mercuri triethanol ammonium lactate, formalin, and copper sulfate. And again, as in the case of wood disinfectants, copper sulfate lends itself most readily to recommending because of its cheapness, availability, and because it is one chemical that these tests show to be effective on either wooden or metallic surfaces. One drawback to the use of copper sulfate on metal is that it causes corrosion. Its corrosiveness, however, is belittled by most growers who have used it on their machinery. For those, however, that do object to such rusting as does take place, use of the non-corrosive quarternaries or formalin is indicated.

Summary

Field data are presented comparing the efficacy of various disinfectants for the inactivation of ring rot contamination on wooden and on metallic surfaces.

Slats of potato crates were inoculated with ring-rot ooze and disinfested in various chemicals. Cut surfaces of healthy seed were then rubbed over the slats to pick up any remaining viable ring-rot bacteria. The seed was planted in randomized replicated rows, and evidence of ring rot survival derived from wilted vines or affected tubers. Disinfec-

tants for wooden surfaces tested in this manner were 1) copper sulfate, 2) mercuric chloride, 3) coal tar phenols, 4) alkyl dimethyl benzyl ammonium chlorides, 5) ammoniacal solution of copper-zinc-phenol, 6) copper naphthanate, 7) chlorinated phenols, 8) N(higher acyl esters of colamino formyl-methyl) pyridinium chloride, 9) calcium hypochlorite, and 10) di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride. Of these at the concentrations tested, only the first five gave complete control.

Disinfectants for metalic surfaces were tested, using screws to simulate such appurtenances of potato production as planters, diggers, and graders. Inoculated and treated screws were thrust into the vascular region of healthy seed, and the seed planted and observed as in the preceding paragraph. Disinfectants for metallic surfaces tested in this manner were: 1) copper sulfate, 2) formalin, 3) alkyl dimethyl benzyl ammonium chlorides, 4) N(higher acyl esters of colamino formyl methyl) pyridinium chloride, 5) di-isobutyl cresoxy ethoxy ethyl dimethyl benzyl ammonium chloride, 6) lauryl isoquinolinium bromide, 7) phenyl mercuri trienthanol ammonium lactate, 8) alkyl dimethyl 3, 4-dichlorobenzyl ammonium chloride pentachlorphenol, 9) sodium paratoluene sulfonchloramide, 10) calcium hypochlorite, and 11) pentachlorphenol. Of these at the concentrations tested, only the first six afforded complete control.

Although other chemicals gave control equal to copper sulfate, the latter is the most logical disinfectant to recommend by virtue of its cheapness, its general availability, and its applicability to both wooden and metallic surfaces. Effective concentration for wooden surfaces was found to be 1 pound copper sulfate in 10 gallons water, and for metallic surfaces, 2 pounds in 10 gallons. Data on the 1-pound-per-gallon rate for metallic surfaces are missing.

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THE EFFECT OF DIFFERENT CONCENTRATIONS OF BACTERIAL SUSPENSIONS USED IN INOCULATIONS UPON SUBSEQUENT RING ROT SYMPTOMS IN THE POTATO PLANT

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The appearance of small amounts of ring rot in certain lots of potatoes has been a basis for speculation as to how and when infection occurred. Moreover, the question arises, "Can slight infection occur in Bliss Triumph or other susceptible potato tubers,—so slight that symptoms may not develop in the plants or tubers that season but yet be sufficient to carry through to the crop the following year or years when definite symptoms will appear?"

With this in mind, an experiment was begun in 1945 to discover the effect of different amounts of inoculum on the subsequent development of ring-rot symptoms in the potato plant.

EXPERIMENTAL METHODS

A bacterial suspension was made by using 3.25 grams of ring-rot ooze from infected potato tubers to 100 cc. of distilled water. This suspension was used in the following concentrations: full strength, 1:2, 1:4, 1:8 and 1:16. Two methods of inoculation were used for each concentration,—that of eye inoculation (stabbed) and that of leaving the cut seed pieces in the bacterial suspension for a period of ½ minute. The seed pieces were then planted in field plots, 10 seed pieces per row, replicated twice. The plants were inspected several times during the summer for ring-rot symptoms.

In 1946 two similar experiments were conducted but with slight modification. (Exp. 1). The suspension was made by adding 7 grams of bacterial ooze to 250 cc. water. Only one method of inoculation was used,—that of dipping the cut seed pieces in the suspension which was used at four concentrations (full strength, 1:10, 1:100 and 1:1000) and for four periods of time (1, 10, 30 and 60 minutes). (Exp. 2).—The bacterial suspension was diluted 1:2, 1:4, 1:8, 1:16, 1:32, 1:64, 1:128, 1:256, 1:512 and 1:1024. Here also, two methods of inoculation were used,—that of eye inoculation and that of soaking the seed pieces in the suspension for a period of 60 minutes.

[1]Plant Pathologist, Wyoming Agricultural Experiment Station, Laramie. Wyo.

Experimental Results

In 1945 the plants were inspected for ring-rot symptoms at three dates,—the 14th and 19th of August, and the 4th of September. The following table shows the per cent of ring rot resulting at each of these dates from the suspension-concentrations used in the two methods of inoculation.

Table 1.—*Ring rot resulting at three dates of inspection from bacterial suspensions, used at different concentrations and in two methods of inoculation.*

Concentration Bacterial Susp.	Per cent Ring Rot					
	August 14		August 19		September 4	
	Susp.*	Eye**	Susp.	Eye	Susp.	Eye
Full strength	45	100	60	100	75	100
1 : 2	30	100	40	100	60	100
1 : 4	44	63	44	63	56	74
1 : 8	45	90	55	100	55	100
1 :16	5	80	25	90	45	90
Average	34	87	45	91	57	93

*Seed pieces left ½ minute in bacterial suspension.
**Bacterial suspension dropped on eye and stabbed in with needle.

Table 1 shows that eye-inoculation gave higher average percentages of ring rot than did the dipping of cut seed in a bacterial suspension for ½ minute. Also, on the 14th of August, 86 days after planting, ring-rot symptoms had developed earlier with eye-inoculation than with the suspension. The effect in resulting ring rot of diluting the bacterial suspension (up to 1 :16) was slight when eye-inoculated, but the effect was considerably greater when the cut tubers were inoculated by placing them in the suspension.

Smears were made from stems taken from each hill in each series. These were stained and examined for the presence of ring-rot bacteria. Each was given a number (1-5) to indicate the relative number of bacteria found on the slide.

The following table shows this relationship:

TABLE 2.—*Relative number of bacteria found on slides at the different dilutions used and with each method of inoculation.*

Dilution of Bacterial Suspension	Method of Inoculation	
	In Suspension (½min.)	Eye Inoculated
Full strength*	2.8**	3.0
1 : 2	3.1	3.2
1 : 4	2.9	3.8
1 : 8	2.5	3.3
1 :16	2.0	3.1

*3¼ grams of bacterial ooze to 100 cc. water.
**Average relative number of bacteria, —1 = slight, 5 = maximum found.

Table 2 shows relatively more bacteria on the slides made from plants originating from seed pieces previously eye-inoculated than from those dipped in bacterial suspensions. Moreover, the relative number of bacteria in those plants, eye-inoculated, did not vary greatly as a result of the different dilutions used as inoculum; however, the number was reduced considerably as the bacterial suspension was diluted previous to inoculation.

In 1946 the experiments were inspected for ring rot at four dates,—the 9th and 17th of August and the 1st and 9th of September. The results are tabulated for each date,—showing the amount of ring rot resulting from the two methods of inoculation and from various dilutions of the inoculum.

In general, there was slightly more ring rot resulting from the eye inoculation than from soaking seed pieces in the suspension. The differences in ring rot between these two methods were greatest in the first inspection but gradually became less in the later inspections.

In the second experiment the effect of the length of period in the suspension as well as the dilutions of the bacterial suspensions was studied. The results are based upon the amount of ring rot found in the plants. An index figure was calculated for ring rot, using 1 for beginning symptoms and 5 for most severe plant symptoms.

Table 4 shows that the more concentrated suspensions produced earlier symptoms as well as the most ring rot. In fact, in this experiment, which was planted one week later than the one previously described, no ring-rot symptoms were manifest from the inoculum having dilutions of 1:100 and 1:1000. In general, more ring rot resulted with

TABLE 3.—*Ring-rot found at four dates of inspection resulting from two methods of inoculation and eleven concentrations of inoculum (plant symptoms).*

Bacterial Suspension	Per cent Ring Rot							
	August 9 Inoculation		August 17 Inoculation		September 1 Inoculation		September 9 Inoculation	
	Susp.*	Eye**	Susp.	Eye	Susp.	Eye	Susp.	Eye
Full strength	84	94	89	100	95	100	100	100
1 : 2	89	89	100	100	100	100	100	100
1 : 4	65	80	80	95	100	95	100	95
1 : 8	55	65	80	100	90	100	90	100
1 : 16	47	75	74	95	90	95	90	95
1 : 32	30	100	60	100	85	100	100	100
1 : 64	63	90	84	95	95	95	100	95
1 : 128	16	42	26	79	53	100	63	100
1 : 256	5	53	26	74	78	100	89	100
1 : 512	10	20	25	45	35	70	40	85
1 :1024	5	0	5	5	5	10	20	20
Average	43	64	59	81	75	85	81	90

*Seed pieces left 60 minutes in bacterial suspension.
**Suspension dropped on eye and stabbed in with needle.

TABLE 4.—*The effect of length of treatment of seed pieces as well as dilution of the bacterial suspension upon the resulting ring-rot.*

Strength of Suspension	Length of Treatment	Per cent Ring Rot				Severity Index Ring Rot
		Aug. 9	Aug. 17	Sept. 1	Sept. 9	
Full strength*	1 Min.	40	60	75	75	3.1
" "	10 Min.	21	58	89	89	3.7
" "	30 Min.	32	47	63	63	2.6
" "	60 Min.	35	75	100	100	4.3
Average		32	60	82	82	3.4
1 : 10 Dilution	1 Min.	0	18	53	53	1.7
" " "	10 Min.	10	40	60	65	2.5
" " "	30 Min.	5	10	30	40	1.0
" " "	60 Min.	15	55	95	95	3.5
Average		8	31	60	63	2.2

1 : 100 Dilution. No ring-rot symptoms found at this dilution.
1 :1000 Dilution. No ring-rot symptoms found at this dilution.

the longer inoculation period, with the exception of the 30-minute period.

SUMMARY

Experiments were started in 1945 and continued in 1946 to determine the effect of different quantities of inoculum on the subsequent development of ring-rot symptoms in the plant.

When seed pieces were eye-inoculated the per cent of ring rot was similar to that obtained by soaking the seed pieces for 60-minute periods in a bacterial suspension but more than that obtained by soaking the seed pieces for periods of ½, 1, 10 or 30 minutes.

In 1945 the dilution of the bacterial suspension (1:16) had only slight effect in resulting plant symptoms when the seed pieces were eye-inoculated. However, when soaked in the suspension (½ minute) there was less ring rot in the plants and also relatively less bacteria as a result of the greater dilution of the inoculum.

In 1946, when the bacterial suspension was diluted to approximately 1:1000, there was only a small amount of ring rot detected in the plants, although the difference in late season was slight at approximately 1:500 dilution or less. As an average for all tests, eye inoculation resulted in an earlier development of ring-rot symptoms than soaking in the bacterial suspension, with the difference gradually becoming less as the season progressed. In another experiment,—as shown in table 4,—planted one week later, no ring rot was detected in the plants

*Seven grams of ring-rot ooze to 250 cc. water.

grown from seed pieces inoculated with the suspension diluted 1:100 and 1:1000. However, this material has been stained and will be examined microscopically as time permits. In addition, tubers have been saved from each of these hills to plant next season for further observation. This study will be continued until adequate information is obtained on the effect of various degrees of inoculum and the period of time necessary to produce plant symptoms.

STEM STREAK NECROSIS OF POTATOES IN RELATION TO SOIL ACIDITY[1]

K. C. Berger and G. C. Gerloff[2]

Department of Soils, University of Wisconsin, Madison, Wis.

During the course of a greenhouse fertilizer and lime experiment with potatoes on a very acid Antigo loam soil, there appeared a severe stem streak necrosis where the soil had been treated with sulfates and chlorides but not when the soil was limed. The necrosis developed also on the untreated acid soil (pH 4.7), but was more severe when fertilizer salts, calcium sulfate or magnesium sulfate were applied. Addition of these salts caused the pH of the soil to drop to 4.5. It was found later that this stem streak necrosis was rather common in northern Wisconsin, especially on fields where potatoes had been grown for a considerable time.

Stem streak necrosis symptoms similar to those here reported were described by Dippenaar (1),[3] who in 1933, while working on scab control in Wisconsin, found that when soils were treated with sulfuric acid so that the resulting pH was lower than 5.1, stem streak necrosis occurred.

Fried and Peech (2) compared gypsum and lime on acid soils for barley, alfalfa, and perennial ryegrass and found that gypsum had a deleterious effect on all plants even though the soils used were low in calcium. They considered the possibility of toxic effects of soluble manganese, iron, and aluminum. Funchess (3) suggested that the factor in acid soils detrimental to plant growth might be excess soluble manganese. Jacobson and Swanback (4) found that as little as one part

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[1]Contribution from the Department of Soils, University of Wisconsin, Madison 6, Wis. Published with the permission of the director of the Wisconsin Agricultural Experiment Station.

[2]Associate Professor and Fellow in Soils, respectively.

[3]Figures in parenthesis refer to "Literature Cited."

per million of manganese in solution culture was harmful to the growth of tobacco.

Because the pH of many of the soils in the potato-growing area of Wisconsin is below 5.0, studies were initiated to determine, if possible, the soil factors which cause this stem streak necrosis. Among the possibilities investigated were influence of a deficiency of calcium and magnesium, strong acidity, and excess of soluble aluminum and manganese.

Nature of Stem Streak Necrosis

Stem streak necrosis appears as dark brown-pitted areas on the outside of stems near the base. They appear early at the base of the petioles and appear as long streaked flecks of brown on the petioles themselves. The streaks on the stems are quite long and narrow and extend into the center of the stem. A pale yellow green chlorosis also appears in the leaves in areas between the veins, whereas the veins themselves remain green. As the symptoms progress, the chlorosis becomes more severe and finally the leaves dry up and fall off. Quite often in severe cases small brown necrotic areas, irregular in shape, appear between the veins near the midrib on the leaflets. The affected parts become extremely brittle so that the peitoles will drop off with a slight touch. As the conditions become more severe, the streak progresses upward, and finally the terminal bud dies and a stunted plant results which dies prematurely,—and consequently the yield of tubers is lowered.

Greenhouse Experiments with Antigo Loam

Antigo loam was treated with various fertilizer and lime materials as indicated in table 1. The soil was first thoroughly mixed and then portioned into one gallon jars. The fertilizer and lime materials were then thoroughly mixed with the soil. Triumph potatoes were then planted.

Stem streak necrosis appeared first on plants receivng 3-12-12 fertilizer plus calcium and magnesium sulfates; next, on those receiving only 3-12-12 fertilizer; and lastly, on those growing on the untreated soil. Plants receiving lime and 3-12-12 fertilizer were normal and healthy as can be seen in figure 1. Plants affected with stem streak necrosis died prematurely, and this lowered the yield considerably as indicated by the data in table 1.

Although the results of this experiment indicate that stem streak necrosis is not caused by a deficiency of calcium or magnesium, a further test was conducted in which the deficiency symptoms of all of the nutrient elements obtained from the soil were produced. In no case

TABLE 1.—*Yield of Triumph potatoes grown in greenhouse on Antigo loam having a pH of 4.7 which was changed by addition of lime and fertilizer as indicated.*

Soil Treatment (Acre Basis)	Soil pH at End of Experiment	Yield of Tubers per Jar: Total Weight Grams	Yield of Tubers per Jar: Number	Severity of Stem Streak Necrosis
Untreated	4.7	89	9	Severe. Symptoms developed in 37 days
1000 pounds 3-12-12	4.5	37	3	Very severe. Symptoms developed in 30 days
1000 pounds 3-12-12+ 2000 pounds lime (1)	5.7	136	7	No necrosis
1000 pounds 3-12-12+ calcium and magnesium sulfates (2)	4.5	40	3	Very severe. Symptoms developed in 28 days.

(1) The lime used was finely ground dolomite; 97.8 per cent passed a 100 mesh screen and 72 per cent passed a 300 mesh screen; it contained 41.0 per cent magnesium carbonate and 50.6 per cent calcium carbonate.

(2) The amounts of calcium and magnesium added were equal to the amounts added to the other pots as limestone.

did deficiency symptoms similar to stem streak necrosis appear. Even though a deficiency of calcium or magnesium in potatoes produces chlorosis in the leaves, it does not produce a stem streaking and flecking.

SOLUTION CULTURE EXPERIMENTS WITH ALUMINUM

The effect of soluble aluminum on potatoes was studied in nutrient solution cultures at various pH levels. Phosphorus was supplied as mono-basic potassium phosphate and was kept separate from the rest of the solution containing the soluble aluminum by means of a divided container and root system in order to prevent precipitation of the aluminum as phosphate. The pH of the nutrient solution was varied from 4.0 to 8.0. Excess aluminum was added in the form of aluminum sulfate, so that the soluble alumina (Al_2O_3) content was as follows:

pH Value	Al_2O_3 in Solution Parts per Million
4.05	134.0
4.25	69.7
4.50	23.0
5.10	3.0
5.70	0.5
6.80	3.0
8.10	9.4

FIGURE 1. Triumph potatoes grown on Antigo loam showing stem streak necrosis at the right.

3B—Normal plant. Treated with 1000 pounds 3-12-12+2000 pounds finely ground limestone per acre. Resulting pH 5.7.

4B—Severe stem streak necrosis. Treated with 1000 pounds 3-12-12+ calcium and magnesium sulfates equivalent to the calcium and magnesium supplied by the lime in 3B. Resulting pH 4.5.

In no case did symptoms of stem streak necrosis appear, although the plants were stunted at the lower pH levels where a high content of soluble aluminum existed. The experiment gave no evidence that soluble aluminum causes stem streak necrosis.

In the parallel experiment where aluminum was excluded and only the effect of hydrogen ion concentration studied, no marked deleterious effects were observed until the pH of the solution dropped below 4.0, or rose above 7.5. No symptoms of stem streak necrosis developed.

SOLUTION CULTURE EXPERIMENT WITH MANGANESE

The possibility of excess manganese causing stem streak necrosis was next investigated. Potatoes, supported on a wire screen, were grown in complete nutrient solutions contained in one gallon jars. The manganese was added as manganese chloride at the rates of 1, 5, 10, 25, 50, 100, and 200 parts per million of solution. Air was bubbled continuously through the solutions, and they were changed completely, as

often as necessary, in order to maintain the proper concentration of nutrients.

The potatoes were sprouted in sand, and when the plants were about four inches high they were transplanted to the screens, which were covered with glass wool.

After nine days, the plants receiving 200 parts per million of manganese developed stem streak necrosis identical with that which developed in soil cultures in the earlier experiment. After two more days, the potatoes in solutions containing 100 parts per million of manganese also showed symptoms of stem streak necrosis. The plants growing in the solution containing 200 parts per million of manganese

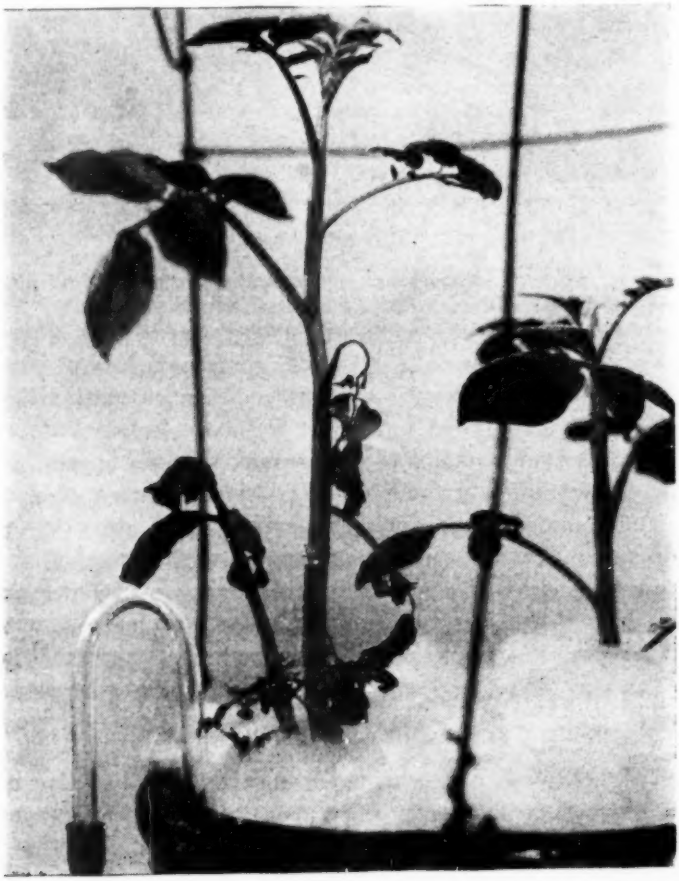

FIGURE 2. Irish cobbler potatoes grown in complete nutrient solution containing 200 parts per million of manganese. Plants show stem streak necrosis identical to that of plants grown on very acid soils.

are shown in figure 2. As can be seen by comparison with figure 1, the necrosis symptoms are alike.

This experiment is still in progress, and the details, together with plant analyses will be reported later. The evidence appears conclusive that excess of soluble manganese is the cause of stem streak necrosis of potatoes.

The manganese of soil becomes much more soluble as the soil becomes more acid. The addition of lime rapidly decreases this solubility by lowering the solvent power of the soil solution, and causing some of the manganese to be changed from the more soluble manganous state to the rather insoluble manganese dioxide.

Summary

During the course of a greenhouse fertilizer and lime experiment with potatoes on a very acid Antigo loam soil there appeared a severe stem streak necrosis where the soil had been treated with sulfates and chlorides but not when the soil was limed. It was found that this necrosis developed quite often in the field when the soils were more acid than pH 5.1.

Stem streak necrosis appears as dark brown pitted areas on the outside of stems near the base. They appear early at the base of the petioles and appear as long streaked flecks of brown on the petioles themselves. The streaks on the stems are quite long and narrow and extend into the center of the stem. A pale yellow green chlorosis also appears in the leaves in areas between the veins, while the veins themselves remain green. As the symptoms progress, the chlorosis becomes more severe and finally the leaves dry up and fall off. Quite often in severe cases small brown necrotic areas, irregular in shape, appear between the veins near the midrib on the leaflets. The affected parts become extremely brittle so that the petioles will drop off with a slight touch. Finally the terminal bud died followed by premature death of the plant and consequent lowered yield.

Greenhouse tests in complete nutrient solutions showed that neither hydrogen ion concentration, soluble aluminum, calcium deficiency or magnesium deficiency were the cause of stem streak necrosis. Further tests with excess soluble manganese showed that in complete nutrient solutions containing 100 and 200 parts per million of soluble manganese, stem streak necrosis was produced which was exactly like that found in potato plants grown on soil. It was therefore concluded that excess soluble manganese is the cause of stem streak necrosis found in potatoes grown on acid soils.

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THE USE OF NEW INSECTICIDES IN THE CONTROL OF POTATO INSECTS

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Each year new materials are developed for control of insects hoping for a "shot gun specific," effective for the control of all insects under every condition. During the war many new insecticides were developed which *almost* reached this expectation as far as potato insects are concerned.

For the past three years at the Lake City Experiment Station, the use of DDT on potatoes has given us unprecedented control of the Colorado potato beetles, flea beetles, and potato leafhopper. At the strengths used, however, six-spotted leafhoppers, tarnished plant bugs, and spittle insects were not so readily controlled. Fairly good control of aphids was obtained in 1945 but these insects were practically absent in 1946.

During 1946 at the Lake City Experiment Station several strengths of DDT, combination of DDT with other materials, and new materials were used both as sprays and dusts on potatoes.

The sprays were applied at the rate of 150 gallons per acre at ten day intervals from the 27th of June to the 29th of August inclusive, and the dusts were applied at the same intervals and dates at the rate of 50 pounds to the acre.

Planting of the variety Menominee on May 16 was used in all plots. These plots were irrigated five times during the season by a rotary sprinkler system.

*Associate Professor of Entomology and Research Professor of Botany and Plant Pathology, respectively.

1. The writers are indebted to Mr. A. M. Berridge, Superintendent Lake City Experiment Station for providing facilities for carrying on this project and continued interest in the investigation.

2. Published by permission of the Director Michigan Agricultural Experiment Station. Journal Article number 855 (N.S.)

Insects were very abundant early in the season. The insects counts were made by taking five complete sweeps on the two inside rows of each plot, one, five, and nine days after applications. The counts showed in most cases that the materials used gave very low insect populations up to five days and were the highest at nine days.

Results of Insect Control

Tables 1 and 2 give the results of the insect counts made at one, five, and nine days after application.

For potato leafhopper control in the spray plots, Bordeax 8-12-100+¾ lbs. DDT, Tribasic + DDT 4-¾-100, Zinc nitrodithioacetate + DDT, 2-1-100, and Tribasic + Hercules 3956 (chlorinated terpene hydrocarbon) 4-¾-100, gave the best results whereas no consistency of control of the six-spotted leafhoppers were observed in any of the plots.

Spittle bugs, tarnished plant bugs as indicated in table 1 were controlled with most of the materials used at least up to five days with a slight increase in population after five days in most cases. Flea beetles were not a problem early in the season but late in August were beginning to appear in numbers. On the 31st of August a killing frost prevented further counts.

In table 2 the results of the dust plots showed the best control of the potato leafhopper by the use of freshly mixed mono-hydrated copper sulfate + lime + 3 per cent DDT; Tribasic + DDT 1 per cent, 3 and 5 per cent DDT impregnated Yellw cuprocide, and Basicop + DDT 3 per cent, up to 5 days after application. The control of the six spotted leafhopper, however, seemed varied, but from all indications control was better five days after applications of the dusts.

Spittle bugs, tarnished plant bugs, and flea beetles were controlled in most instances over the nine day intervals by most of the dusts used. As compared with results from the same insecticides on spray plots, the applications of dusts appeared to give better control of the above insects this year.

Summary

In spraying and dusting experiments carried on at the Lake City, Michigan Experiment Station, potato leafhoppers, 6-spotted leafhoppers, spittle insects, and tarnished plant bugs were abundant throughout the growing season of 1946.

None of the materials tested gave better insect control than DDT alone or this insecticide in combination with Bordeaux or the fixed coppers. Using the same strength materials, the dusts appeared to give

TABLE 1.—*Insect control on potato spray plots 1946—Lake City Experiment Station.*

MATERIALS	Potato Leafhoppers			Six-Spotted Leafhoppers			Spittle Bugs			Tarnished Plant Bugs			Flea Beetles			Bu. Per Acre Total Yield
	*1	5	9	1	5	9	1	5	9	1	5	9	1	5	9	
Bordeaux + DDT (8-12-100 + ¾ lb.)	0	1	10	4	1	5	3	2	1	0	1	1	0	0	0	241.7
Bordeaux + DDT (8-4-100 + ¾ lb.)	0	1	17	1	2	4	1	2	3	0	2	3	0	0	0	212.3
Tribasic + DDT (4-½-100)	0	1	17	4	2	2	3	3	1	4	1	4	0	0	4	212.1
Tribasic + DDT (4-¼-100)	0	0	22	6	0	11	5	2	9	2	2	7	0	0	7	219.7
Tribasic + DDT (4-¾-100)	1	1	10	3	1	2	1	2	2	2	0	1	1	0	2	226.4
Tribasic + Sul. + DDT (4-4-¼-100)	0	1	27	5	4	8	5	0	6	0	1	11	0	2	4	235.5
Zinc nitrodithioacetate + DDT (2-1-100)	0	0	8	1	4	5	2	1	3	0	1	2	0	0	2	227.5
Bordeaux + B.H.C. (8-4-2-100)	0	2	18	5	6	4	1	0	6	0	1	4	0	1	0	203.2
Tribasic + B.H.C. (4-2-100)	2	1	32	5	9	2	4	2	9	0	0	6	2	1	3	180.6
Zinc Nitrodithioacetate + B.H.C. (2-2-100)	0	1	15	7	8	6	1	2	3	1	1	5	0	0	0	199.0
Copper nitrodithioacetate + B.H.C. (2-2-100)	0	3	26	9	14	3	1	4	3	2	1	4	0	1	4	196.0
Tribasic + Diethyl (4-1 pt.-100)	0	0	29	3	7	7	2	3	6	1	1	2	0	0	1	241.8
Tribasic + Omilite + DDT (2-1 qt.-¾-100)	0	0	34	0	6	11	3	3	6	0	0	2	0	1	4	231.7
Tribasic + Hercules 3956 (4-¾-100)	1	0	8	6	6	1	3	1	3	2	1	0	1	0	4	322.5
DDT alone (¾-100)	0	1	33	5	6	2	3	0	4	2	2	3	0	1	0	226.9
Dithane + Zn + L + DDT (2 qts.-1-½-¾-100)	0	1	24	2	5	6	1	4	5	7	1	2	0	0	4	275.5
F-48 + Diethyl alternating (4-1 pt.-100)	1	2	23	8	13	10	2	4	7	3	1	6	1	3	5	325.4

*Counts made 1-5-9-days after application

TABLE 2.—*Insect control on potato dust plots* 1946—*Lake City Experiment Station.*

MATERIALS	Potato Leafhoppers			Six-spotted Leafhoppers			Spittle Bugs			Tarnished Plant Bugs			Flea Beetles			Bu. Per Acre Total Yield.
	*1	5	9	1	5	9	1	5	9	1	5	9	1	5	9	
Mono. Copper + Lime + DDT 3 per cent	0	0	3	12	9	0	0	1	0	0	6	1	0	0	0	356.1
Copper A + P.C.H. 10 per cent	0	0	11	6	10	7	0	3	0	1	2	5	1	3	2	357.9
Tribasic + DDT 3 per cent	0	0	13	11	3	7	0	2	1	2	3	9	0	1	2	361.1
Tribasic + DDT 2 per cent	0	0	11	2	2	6	2	1	1	1	3	7	0	0	1	307.1
Tribasic + DDT 1 per cent	0	0	6	4	1	1	2	0	0	0	2	5	0	0	1	343.6
Tribasic + DDT ½ per cent	0	0	14	8	0	4	1	2	0	0	2	3	0	1	1	316.1
Tribasic + Sul. 40 per cent + DDT 3 per cent	0	1	20	5	2	5	1	1	0	0	2	3	0	0	2	353.1
Y. Cuprocide + DDT (Impreg.) 3 per cent	0	0	6	2	1	6	0	2	3	0	4	1	0	0	1	376.1
Y. Cuprocide + DDT (Impreg.) 5 per cent	0	0	5	15	6	2	2	2	1	0	1	3	2	0	0	380.4
Tribasic + B.H.C. 10 per cent	0	0	16	24	2	3	3	2	0	0	2	4	0	1	3	364.5
Basicop + DDT 3 per cent	0	0	4	9	1	3	2	2	3	1	0	2	0	1	0	357.6
DDT alone 3 per cent	0	0	18	13	3	5	1	3	0	3	3	2	0	0	0	369.0

*Counts made 1-5 and 9 days after application.

somewhat better control than the sprays on spittle insects, tarnished plant bug, and flea beetles.

Because of the fact that the spray and dust plots were located on different types of soils and with different levels of fertility, no comparison can be made of the yields between the series of plots.

SECTIONAL NOTES

ALABAMA

Next Monday, the 5th of May, our growers will start harvesting their Irish potato crop in earnest, weather permitting. Our present estimates give us only about a 60 per cent of normal crop this year. Indications are that Baldwin County will ship about 2,500 cars,—300 bags each. Our total shipments for the Commercial crop in this section will be less than 3,500 cars if present estimates pan out. This means that our growers will probably come out but profits will not be handsome.

Late Blight was first found on the 17th of April and after a few days of development has spread to most of the earliest sections of our deal. Growers discouraged because of weather conditions which prohibited dust and spray programs to be carried out, seemed to become careless in Blight control after the break in the rains. This probably has contributed to the fast spread of the blight. The writer thinks that Late Blight probably will cost us more this year than last despite the fact that it was found 23 days later this year than last. The Sebago variety will probably be less damaged than the Triumph as Blight does not seem to keep them from sizing up to market size.

Most of our growers have complied with the support price revisions and will be in a position to receive $2.20 per hundred for their U. S. No. 1 potatoes delivered at the sheds should the market go that low. With the short crop, there is a feeling that our potatoes should move above this figure. We can expect a higher per cent of B size than average with the growers support at $1.20 per hundred.

Certification Officials from our seed-producing states were able to secure good readings on the more than 170 seed source samples and some 17,000 index tubers planted at the Gulf Coast Substation Fairhope, Alabama. There are indications that there was little spread of virus diseases in most of the seed-producing states. It is not the exception to find sample after sample with a clear reading. At present a special ring-rot reading will be made. (May 21).—FRANK E. GARRETT.

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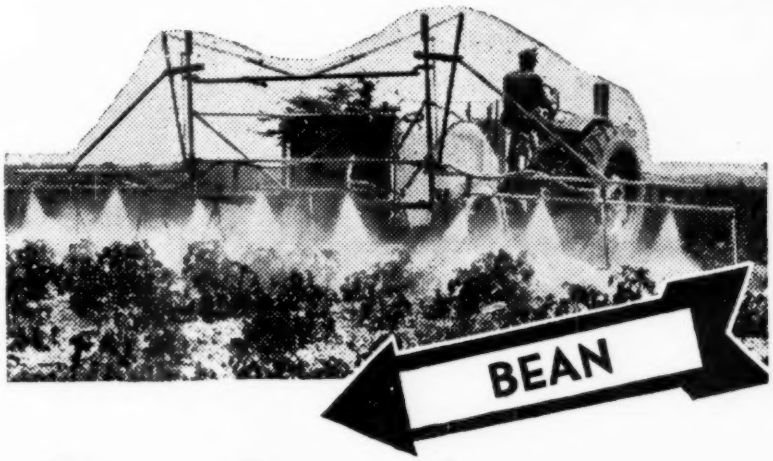

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CALIFORNIA

Our peak shipment to date by rail is 270 cars, all of which are being harvested in the Edison early section. The entire potato producing area, however, is now rapidly getting in condition to start harvest.

We expect to harvest this year in the floor of the valley approximately 48,000 acres instead of roughly 61,000 acres in 1946. The price is gradually declining and may be down to $2.50 per hundred by the time this letter reaches you. The quality of the crop to date is above average. The yields are above average. There was little compliance with the goals in the early Edison district as compared to the rest of the county, primarily because the early producers felt that their crop would be marketed well above ceiling and did not support the government program. In the remainder of the producing areas, however, a very high percentage of the growers planted within their goal as established by the Department of Agriculture.

There is a movement afoot at the time in Kern County to organize and establish a California Marketing Agreement. The first public hearing was held yesterday. No one is in a position to know what the final vote of the growers will be. This should be known within approximately 30 days. (April 30).—M. A. LINDSAY.

COLORADO

The potato marketing season is rapidly reaching the end in Colorado. The San Luis Valley completed moving the bulk of its Red McClures several weeks ago. Weld county is still shipping potatoes but is rapidly cleaning up as planting time approaches.

The indications are that Colorado growers will, in general, stay within their allotted acreages. Some few growers will exceed their individual allotments but the state acreage will probably not exceed the state allotment of 83,300 acres. The early planting will begin about the 15th of May continuing on into June with some certified seed plantings as late as the first of July. The certified seed market has been very active for the past month, particularly for Bliss Triumph and Red McClure. The Irish Cobbler market has been dull all season for both commercials and certified seed.

In Weld county the moisture situation is the best in years with several light snows and rains in April providing ample moisture for a good seed bed. In the San Luis Valley, it has been quite dry but with a better water supply than last year. (May 1).—CECIL W. FRUTCHEY.

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Field tests made during the 1946 season showed Syndeet-30 to be the outstanding emulsion type DDT spray for insect control. It proved more *effective*—more *economical*.

Recommended Dosages

For Flea Beetles, Leaf Hoppers and Colorado Potato Beetles—use 1 pint of Syndeet-30 per 100 gallons of water. Apply at the rate of 100-150 gallons per acre.

For Aphids and other potato insects—use 1 pint of Syndeet-30 per 100 gallons per acre if infestation is light. Use 1 quart per 100 gallons if infestation is heavy, and apply at 130-150 gallons per acre.

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INDIANA

Our spring is late and very few plantings have been made. If other states are the same, there will be a great need to hold on to the available stock of last year's crop. This year's plantings and the early harvest are on our markets now. The quality is good and the demand strong.

We will continue to carry on our date of planting experiments, weather permitting, and we may be a week late in our first planting.

Good seed is very scarce here in Indiana and, as usual, Katahdin, Irish Cobbler, Sebago and Sequoia are in greatest demand. (April 28). —W. B. WARD.

MAINE

Maine shipped approximately 1,000 more cars on the 7th of May then they shipped by the 15th of June last year. Guesses indicate that Maine will ship between 57,000 to 58,000 cars in all.

The last week has been cold and rainy and indications are that Maine will be at least one week to two weeks behind in their planting.

The volume of certified seed sold now totals 8,229 cars compared with last year's 7,702 cars. On the basis of the Florida test, Maine is planting the best seed in its history. Seed sales among the farmers in the county appear higher also.

Maine had too many Irish Cobblers last year and it seems apparent there is a decided drift away from that variety this year. Very few Aroostook farmers are treating seed before planting.

Farmers have received their acreage allotment from the Triple A. It is estimated that over 90 per cent of the farmers will participate.

Commissioner A. K. Gardner has ruled that it will not be necessary to isolate the Chippewa variety 250 feet for certification purposes. There is a requirement that Chippewas must be tested in Florida before final certification. Last year several fields that were rejected because of distance had as good a reading as some Chippewas that passed certification. Because this has happened for the past two years, Commissioner Gardner believes that if Chippewas pass the Florida test they have met certification requirements. (May 7).—VERNE C. BEVERLY.

MISSOURI

Continual rain and generally cool temperatures throughout March and April have given the Missouri potato crop a slow start. Planting got underway during the third week in March and continued, at interrupted intervals, throughout all the month of April. Reports indicate

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PENCO

that somewhere between 85 per cent and 95 per cent of the intended acreage finally got planted. The 1947 acreage is estimated slightly smaller than that of 1946.

The first plantings of potatoes are coming up slowly and irregularly because of the cold wet soil and very little sunshine during April. There was some evidence of seed piece decay in the early plantings. Currently, this is not thought to be too serious.

All fields were fertilized and the rates were quite variable, ranging from 400 pounds to 1,300 pounds per acre. Many growers used 10-6-4, but owing to fertilizer shortages, some other formulas were also used. Most growers side dressed with 10-6-4, but some used 8-8-8 whereas others used ammonium nitrate.

Irish Cobbler was the leading variety, with Warba and Triumph next in rank. (May 6).—ALLAN PURDY.

NEBRASKA

At this time, Nebraska potato farmers are in the process of getting land prepared for the planting of the late crop, which will begin about the 10th of June. This consists of, in some cases, discing the land, to prevent early weed growth, particularly on the dry land territories. Under irrigation, where most growers follow the practice of growing alfalfa or sweet clover, preceding the potato crop, the land will be plowed within the next week or two, then thoroughly worked and finally "floated" prior to the planting operation. Since we have had a cool spring, the growth of alfalfa and sweet clover has been slow, and is not up to what is considered normal for this time of the year. Most growers like to have somewhere between one and two feet of green matter to turn under, however, that may not be the case this season.

Quite a few growers are dipping their potatoes with hot formaldehyde for the purpose of controlling scab and retarding sprout growth prior to planting. This dipping process is also recommended for control of any contamination that may be on the surface of the potato or the sacks. This applies particularly to Ring Rot, where seed potatoes have been transferred from one storage to another. It is of course, of no value to control Ring Rot infection within the tuber.

The potato program for the late crop contemplates an allotment system, and growers are being signed up under this program. The late crop allotment is somewhat in excess of last year's acreage because the over-all plantings have been down in this state for some time. The plantings on the early crop of central and eastern Nebraska were completed just a short while ago, considerably later than usual. The late, cold

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spring, combined with excessive rainfall during March and early April, delayed plantings beyond the usual date, which is about the 1st to 10th of April. Conditions otherwise are favorable, so the crop should advance, and with warm weather recently, this should make up for lost time. The acreage planted in the early territories, is considered as below normal. The principal variety is Red Warba, having crowded out Cobblers over the past few years. Some Bliss Triumphs are planted, and of course, there is still a certain amount of Irish Cobblers, but they are distinctly in the minority.

Certified potato growers were recently informed of the results on their southern test plat plantings. In most cases, these results were favorable. As a matter of fact, the quality of the seed to be planted in the coming season is considered improved over that planted a year ago. The neglect of war years was very apparent in test plantings made in the spring of 1946 in the southern states. As a result, a great deal of effort was spent by certification officials and growers themselves in improving the crop. This, of course, was done by discarding poorer, low quality seed stocks, substituting better seed, and by roguing of seed plots. For the first time in many years, thorough roguing was possible, and the results were apparent in the testing program carried on during the winter. This situation is undoubtedly duplicated in many other territories. (May 6).—MARX KOEHNKE.

NEW YORK

The table stock market advanced strong with the balance of local supplies going at about $3.50 cwt. f.o.b. It is only the 1st of May and there are no more potatoes available than would be expected in a normal year.

Seed potatoes are about cleaned up also, at least three weeks ahead of average. The demand has been good during the last few weeks but the volume was below normal indicating that the acreage intentions are below average. In fact the State Crop Report indicates about 12 per cent decrease from last year.

Our New York growers are going into Tetons quite extensively because this variety has been found to be not only resistant to ring rot and also certain virus diseases, besides being a good yielder of well-shaped tubers, Teton seems to keep pretty well and recent tests indicate that they are superior when it comes to making potato chips. About 200 acres will be entered for certification this year.

Much interest is being shown in marketing agreements and several National and state wide meetings have been held at which this subject

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ORIGINATORS OF DDT INSECTICIDES

was the chief one discussed. Before making any recommendations every one wants to learn all he can about agreements and how they will fit New York state conditions. It is expected that something will sugar-off in the near future. (May 2).—H. J. Evans.

RHODE ISLAND

This has been a very cool, wet spring, and farmers are way behind with their planting. Many growers have been forced to hold cut seed so long that it has spotted rather badly. Stem-end browing has shown up in the seed this year more than for several years past.

As a whole, growers are sticking closely to their allotments. If the weather doesn't improve soon, some growers will not even plant their entire allotments.

The new Rhode Island Potato Growers' Association is right on its toes. The executive committee has held several meetings and made plans which should benefit the growers. (May 7).—Avery E. Rich.

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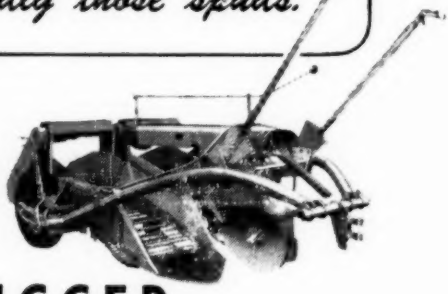

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